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To Mr. N.M. Thompson
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INFLUENCE OF 230-kV LINE ON CHEX RADIO STATION PATTERN

R.C. Madge

Field strength measurements of the day and night patterns of the CHEX radio broadcast antenna in Peterborough have been performed both before and after construction of the Marine JctxOtonabee TS 230-kV line. The differences between the before and after measurements can be attributed to the new line, to new construction near test points and between the antenna and test points, to locally changing ground conductivity and to operator error. The measured differences between the before and after measurements for both the day and night patterns are so small however, that the line can be assumed to have negligible effect on these patterns.

The newly constructed Marine JctxOtonabee TS 230-kV line passes within 685 metres of the closest antenna in the 4-antenna CHEX radio-broadcast array. In order to try to determine the effect this line would have on the radio station pattern, measurements were taken both before construction (November, 1981) and after completion (November, 1982) of the line.

Bill Marchand, representing CHEX, took the 'before' measurements, with Don Jones of Ontario Hydro in attendance. Bill Marchand, and Rick Madge of Ontario Hydro took the 'after' measurements, with Don Jones in attendance. The field strength readings were taken at 32 test points for each of the day and night patterns at CHEX's frequency of 980 kHz. Figure 1 shows the layout of the area. Appendix B lists the operators and equipment and Appendix D lists the test points and description of each.

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ANALYSIS AND DISCUSSION OF RESULTS

Due to the very small differences between sets of readings, the analysis was limited to comparison of actual measured values. There seemed to be no need to factor out overall ground conductivity changes or radio station power output changes. For the after measurements the value used in analysis was the average of the two meters. Appendix C lists the measured values for both tests.

Figures 2 and 3 represent the measured before and after values at all 32 test points for the day and night patterns respectively. The variations seen can be attributed to the new line, to new construction near test points and between the antenna and test points, to locally changing ground conductivity, and to operator error. As there is very little variation seen in the graphs, the effect of the new transmission line can be assumed to be negligible.

With two meters being used in the 'after' tests, an opportunity arises to determine the extent of operator error. Appendix A lists the method of calculation and results. It can be seen that both operators had small errors associated with their measurements. This gives a high degree of confidence in the results.

CONCLUSIONS

There is very little difference between measurements taken before construction of the Marine JctxOtonabee TS 230-kV line and measurements taken after completion of the line. The differences that do exist can be attributed to the new line, to new construction near the test point and between the antenna and the test point, to locally changing ground conductivity, and to operator error. It is expected that the contribution of the transmission line to these variations is negligible.

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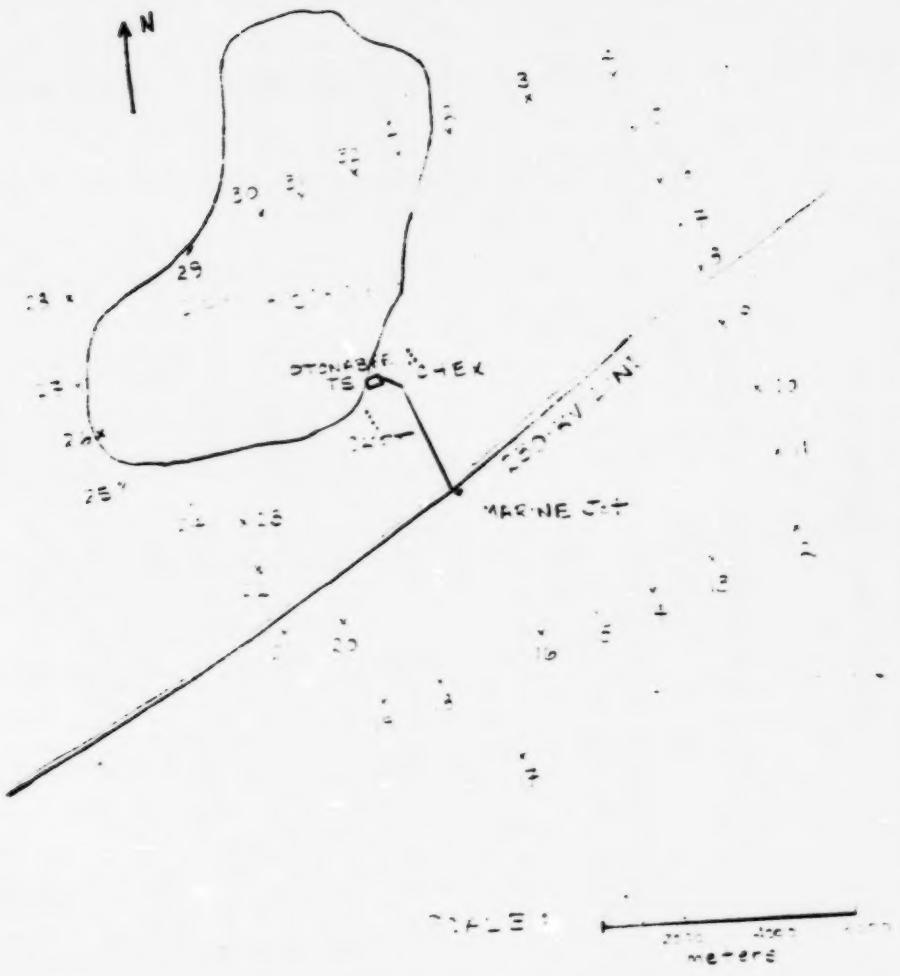
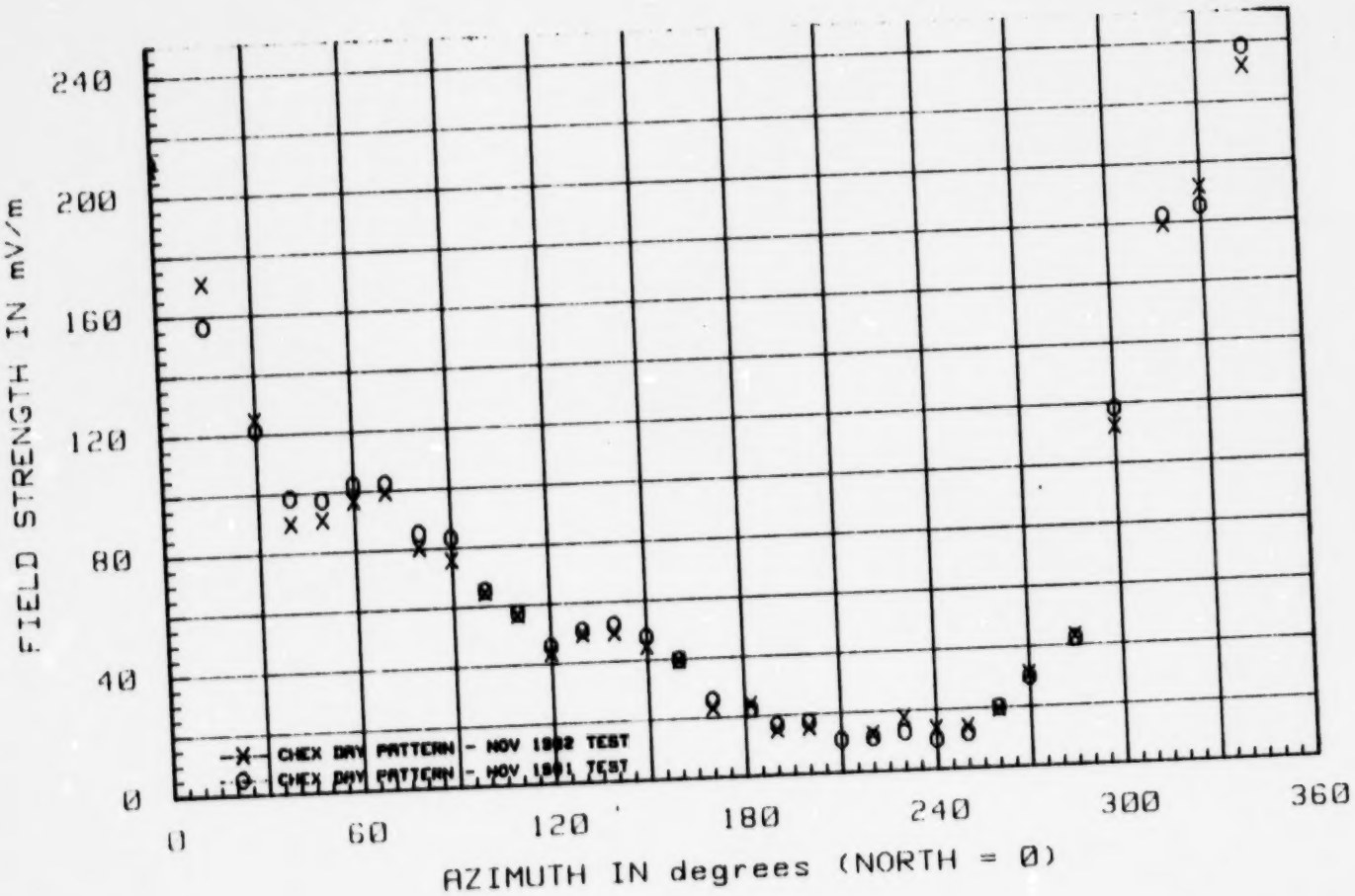


FIGURE 1

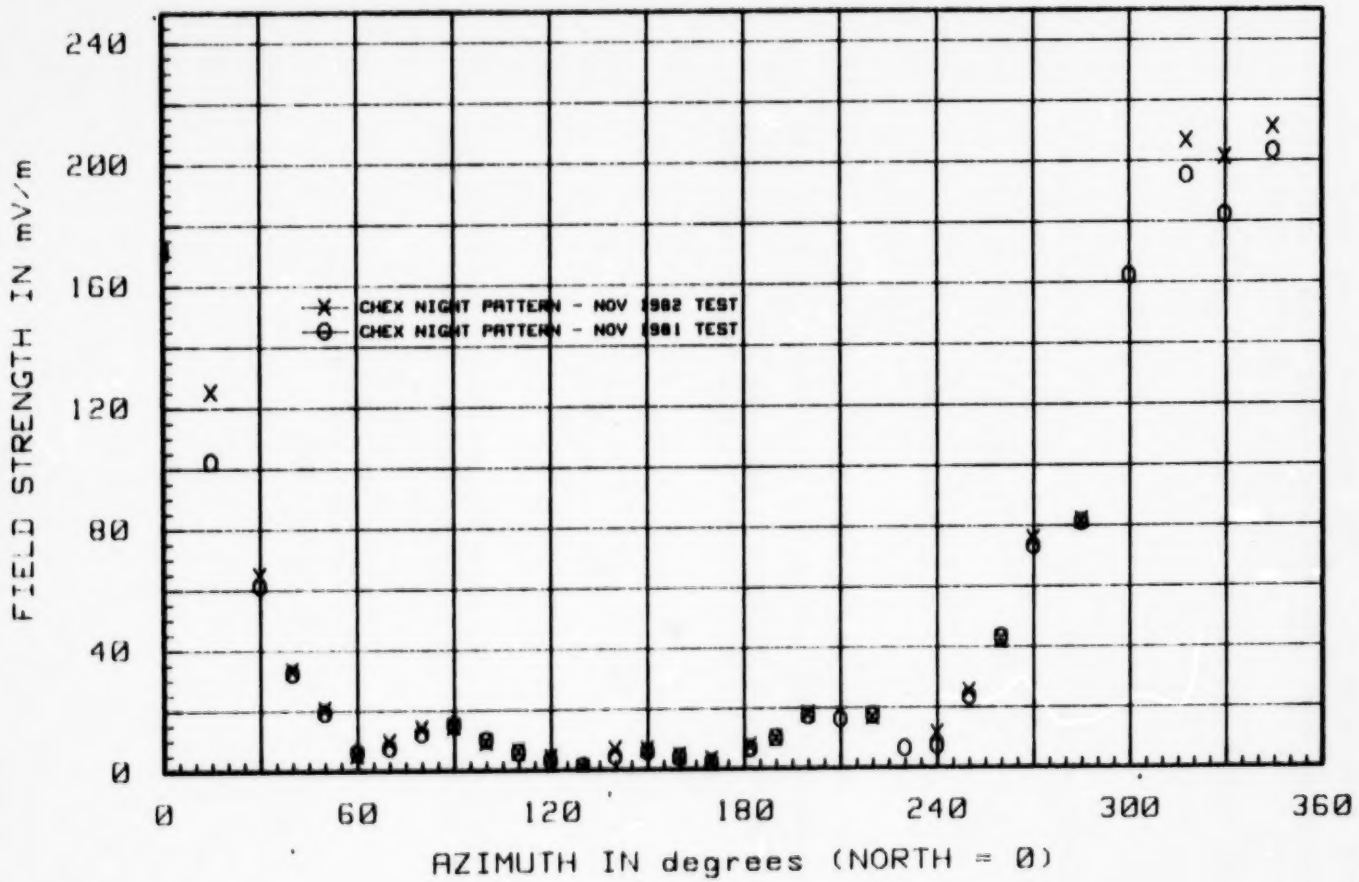
LAYOUT OF AREA AND POSITIONS OF TEST POINTS SURROUNDING CHEX BROADCAST ARRAY



CHEX DAY PATTERN

MEASURED FIELD STRENGTH AT 32 TEST POINTS

FIGURE 2.



CHEX NIGHT PATTERN

MEASURED FIELD STRENGTH AT 32 TEST POINTS

FIGURE 3.

APPENDIX A

Method of Calculating Operator Error

The operator error was calculated as follows:

1. The test point average ($\overline{TP}_i$) for each test point was calculated. Each meter average ($\overline{M}_N$) was calculated over all the test points.

2. A factor (F_N) was obtained to cancel meter calibration errors:

$$F_N = \overline{M}_N / \overline{T}$$

where $\overline{T}$ is the average of all test point averages

$$\overline{T} = \frac{\sum_{i=1}^{32} \overline{TP}_i}{32}$$

3. A variation (V_{Ni}) for each meter at each test point was obtained by comparing the actual meter reading (M_{Ni}) to the test point average corrected for the meter calibration. The result was put in percentage form

$$V_{Ni} = \frac{M_{Ni} - \overline{TP}_i * F_N}{\overline{TP}_i * F_N} * 100$$

4. The maximum positive and negative variations were found, and a standard deviation was calculated on the variations

$$SD_N = \sqrt{\frac{\sum_{i=1}^{81} V_{Ni}^2}{80}}$$

TABLE A-1

STANDARD DEVIATIONS AND VARIATIONS OF OPERATOR ERROR FOR 'AFTER' TEST

Meter	Day Pattern				Night Pattern			
	Standard Deviation %	Variation			Standard Deviation %	Variation		
		Max + %	Max - %	Spread %		Max + %	Max - %	Spread %
CHEX	0.7	1.4	-1.5	2.9	0.8	1.4	-1.3	2.7
Ontario Hydro	0.7	1.5	-1.4	2.9	0.8	1.3	-1.4	2.7

APPENDIX B

BEFORE TEST; NOVEMBER, 1981

Affiliation	Operator	Meter	Calibration Date
CHEX	Bill Marchand	FIM21-657	March 14, 1979

AFTER TEST; NOVEMBER, 1982

Affiliation	Operator	Meter	Calibration Date
CHEX	Bill Marchand	FIM21-657	May 13, 1982
Ontario Hydro	Rick Madge	FIM21-786	April 5, 1982

APPENDIX C

CHEX DAY MEASUREMENTS

TEST POINT	AZIMUTH degrees	NOV. 1981 CONS mV/m	NOVEMBER, 1982 CONS mV/m	OH mV/m	COMMENTS ON 1982 MEASUREMENTS
1	0°	211	209	210	? Point-16% Variation on moving 25'
2	15	156	172	169	
3	30	121	127	122	
4	40	98	91	88	
5	50	97	92	89	
6	60	102	98	95	
7	70	102	100	98	
8	80	85	80	80	
9	90	83	76	75	
10	100	65	65.5	63.5	
11	110	57	57	56	
12	120	45.5	43.5	43	
13	130	50.5	49.5	49	
14	140	52	49.5	49	
15	150	47.5	44.5	44	
16	160	39.5	39.3	39.2	
17	170	25.5	23	23	Exact Location in-
18	182	22	23.4	23.8	? Point-accessible due to water
19	190	16.2	14.9	14.7	
20	200	17	15.3	15.3	Building now over Bad Point-Test Point
21	210	10.7	9.9	9.8	
22	220	11	12.2	12.2	
23	230	12.5	17.5	17.3	
24	240	9.6	13.5	13.4	Bad Max to Null
25	250	11.4	13.6	13.7	? Point - ratio
26	260	19.8	19.4	19.4	
27	270	29.5	30.6	30.8	
28	285	42	43.1	42.5	
29	300	118	112	11.2	? Point-Bad Max/Null
30	318	182	180	178	? Point-Bad Max/Null
31	330	185	192	191	
32	345	238	232	231	

CHEX NIGHT MEASUREMENTS

TEST POINT	AZIMUTH degrees	NOV. 1981 CONS mV/m	NOVEMBER, 1982 CONS mV/m	NOVEMBER, 1982 OH mV/m	COMMENTS ON 1982 MEASUREMENTS
1	0	171	172.0	170.0	
2	15	102	127.0	123.0	
3	30	61	65.0	64.0	
4	40	32	33.1	33.0	
5	50	19	20.2	20.2	
6	60	5.9	5:3	5.1	
7	70	7.3	9.4	9.2	
8	80	12	13.8	13.9	
9	90	15	14.4	14.5	
10	100	9.8	9.4	9.2	
11	110	5.8	6.0	5.9	
12	120	3.3	4.1	4.1	
13	130	1.2	.8	.7	? Point - Poor Max/Null
14	140	4.1	6.7	6.5	
15	150	5.8	6.4	6.5	
16	160	3.9	4.4	4.3	
17	170	2	3.0	3.0	Exact Location in-
18	182	6.5	7.6	7.3	? Point-accessible due to water
19	190	10	10.1	9.8	
20	200	17.2	17.8	17.8	
21	210	16	14.8	14.0	Bad Point-Different Location
22	220	17.2	16.8	16.7	
23	230	6.2	7.3	7.2	Bad Point - Bad Max/Null
24	240	6.9	11.2	11.3	
25	250	23.2	25.2	25.0	
26	260	43	42.5	42.5	
27	270	73	77.0	74.0	
28	285	81	83.0	80.0	100% Variation
29	300	162	173.0	150.0	Bad Point-over 50'
30	318	195	208.0	205.0	
31	330	182	200.0	202.0	
32	345	203	211.0	211.0	

APPENDIX D

POINT	BEARING	DESCRIPTION
1	000°	Through green gate N. side of road, 0.15 km. E. of road to south.
2	15	Marked S. side of road 0.18 km. east of intersection. Reading in field to south.
3	30	Marked S. side of road 0.8 km. east of intersection. Reading in field to south.
4	40	Marked on W. side of road 0.2 km. south of corner. Reading on E. side of road.
5	50	Marked on W. side of road on snow plough marker 0.3 km. south of railway. Reading in field on E. side behind pine trees.
6	60	Just south of highway 7. Reading in field on E. side opposite entrance to trailer park.
7	70	Marked on E. side 1.3 km. S. of highway 7. Reading point reached by walking up lane to E. south of the marker, then N. into bush just E. of shed. Number 7 is painted on a fallen tree at the reading point.
8	80	Marked on fence post W. side 2.5 km. S. of highway 7. Reading over fence in field on west side.
9	90	Marked on fence post to W. 0.6 km. S. of intersection of road to west. Reading over fence in field to west.
10	100	On road to Lang. Reading at edge of lawn at 2nd 50 km. speed limit sign.
11	110	Marker on fence post E. side 0.7 km. S. of intersection. Reading over fence to east.
12	120	At curve west edge of village of Keene. Reading on lawn of house on hill S. side of road.
13	130	Marker on post on N. side of road. Reading south. 1.18 km. west of intersection.
14	140	South east corner of intersection at Mathers corners. Reading on lawn behind Mathers Funeral Chapel.
15	150	Marker on fence post N. 0.08 W. of intersection Reading over fence in field to north.
16	160	Reading at brow of hill north west field at intersection.
17	170	1.15 km. E. of intersection of road to S. Reading in field to south.
18	182	Reading at edge of trees opposite intersection of road to west.

POINT	BEARING	DESCRIPTION
19	190	Marker on fence N. 1 km. west of intersection to south. Reading at roadside.
20	200	Marker W. 2.14 km. north of intersection. Reading in bush east side of road.
21	210	Grassy area at Stewart Hall intersection.
22	220	At intersection of dead end road to W. 1.3 km. north of Stewart Hall intersection. Reading at roadside.
23	230	Marker Hydro pole W. 0.4 km. north of intersection of road to E. Reading in field to W.
24	240	Reading in lane to marina.
25	250	At field entrance with large culvert before stop ahead warning sign for highway 7. Reading in E. field across culvert.
26	260	Lawn of house E. side 1 km. N. of highway 7.
27	270	Lawn of house with fire hydrant in front 1 km. N. of highway 28.
28	285	Marker on Hydro pole S. 0.7 km. E. of intersection. Reading in field between houses on north side of road.
29	300	Staff parking area in park.
30	318	Park beside river north side of road. Walk in beyond tree with sign.
31	330	North side of road. Walk in beyond lock.
32	345	West edge of lawn of house immediately E. of school.

POOR

QUALITY

ORIGINAL